Developing bycatch reduction technologies

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WWF

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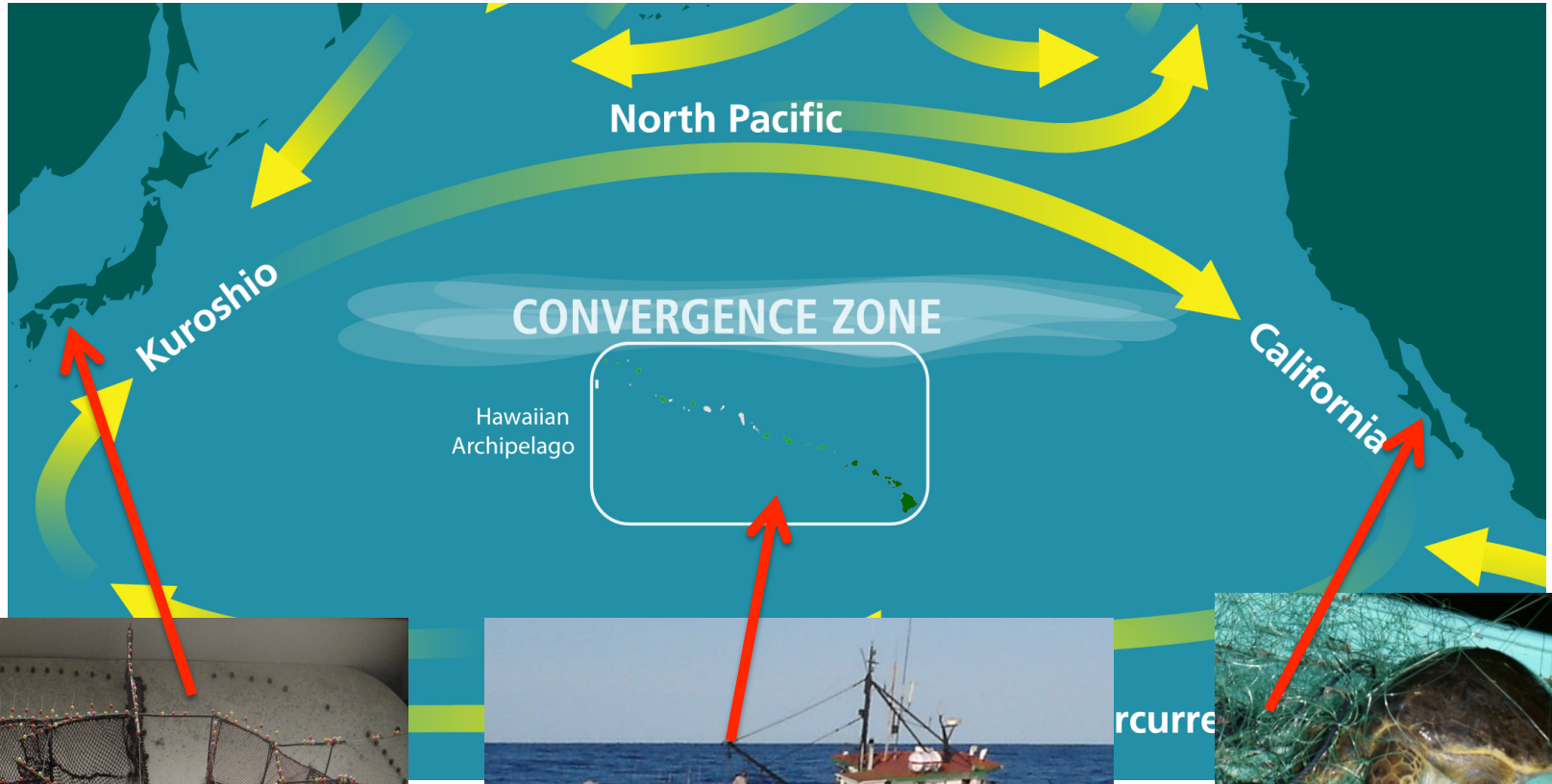
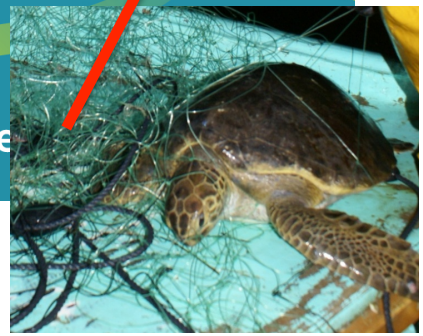
Developing bycatch reduction technologies (BRTs) for sea turtles



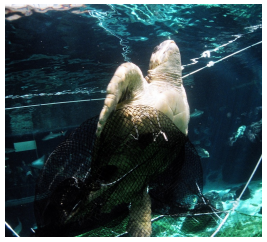
Coastal pound net fisheries :
Pound net escape devices

Longline Fisheries:
Circle hooks, offset hooks,
appendage hooks



Coastal Gillnet Fisheries:
Visual cues (net illumination**)**

Developing bycatch reduction technologies (BRTs) for sea turtles



I. Japanese pound net systems
   - A. Bycatch and mortality rates
   - B. Developing escape devices

II. Net Illumination as a BRT for coastal gillnets
   - A. Initial experimental system
   - B. Expansion of net illumination studies
     1. Peru
        - a. Potential for a multi-taxa BRT
     2. Indonesia

III. New technologies/New directions

IV. Lessons learned

I. Japanese pound nets (*teichiami*)

HUGE STRUCTURES

Length: 200 - 325m

Width: 50 - 90m

Depth: 20 - 50m

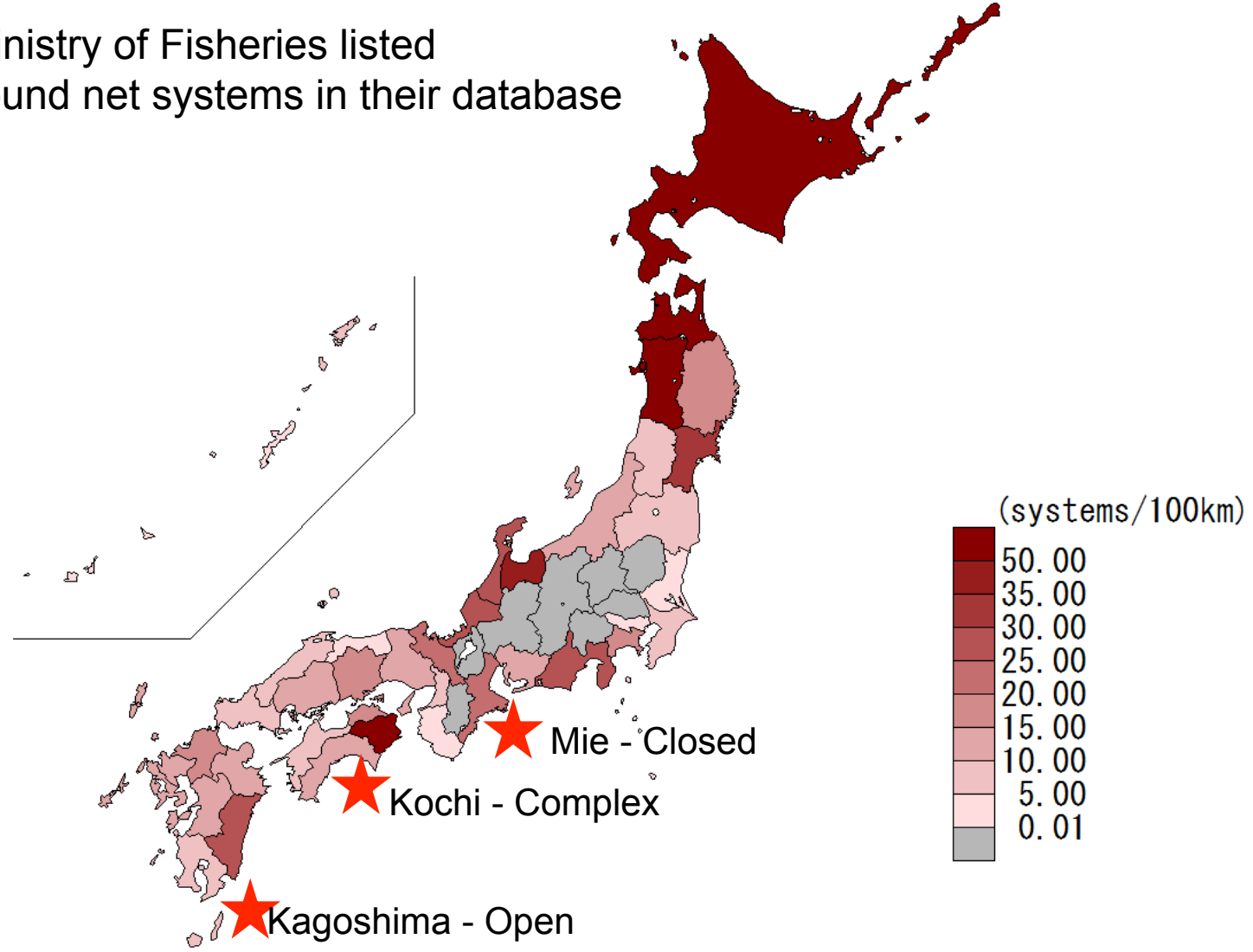
Costs: $2.5 - $6 million USD

Open type:
Access to sea surface

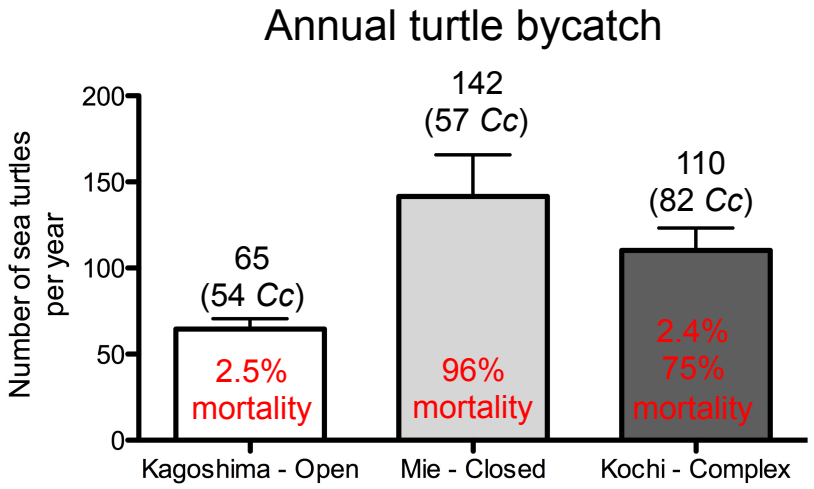
Roofed type:
Nets are submerged

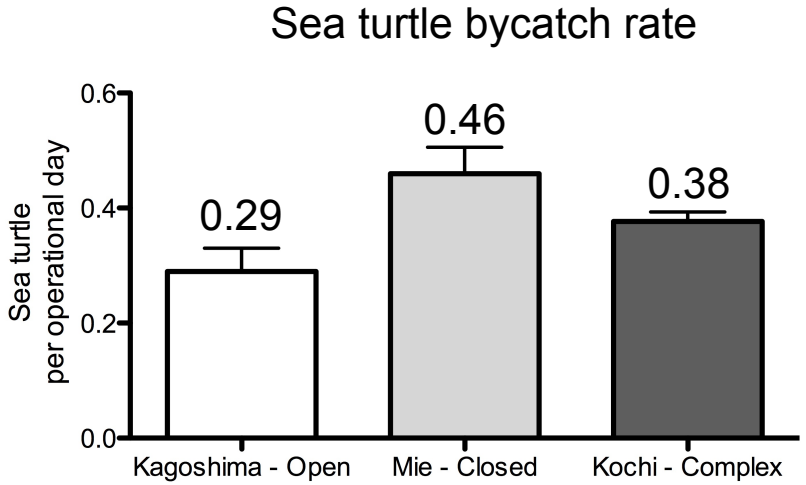
Sea turtle bycatch monitored by STAJ in 3 pound nets systems

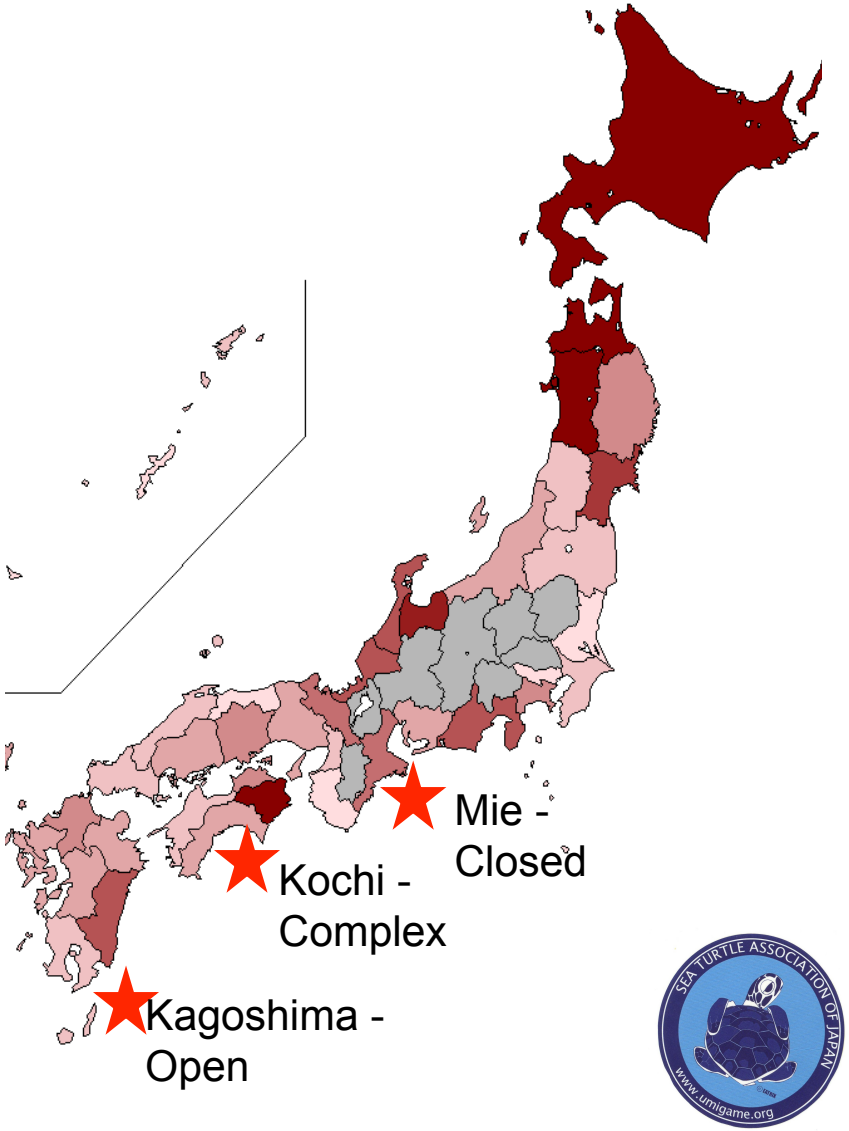
Japan Ministry of Fisheries listed
7,647 Pound net systems in their database



Sea turtle bycatch monitored in 3 pound net systems from 2007 to 2013



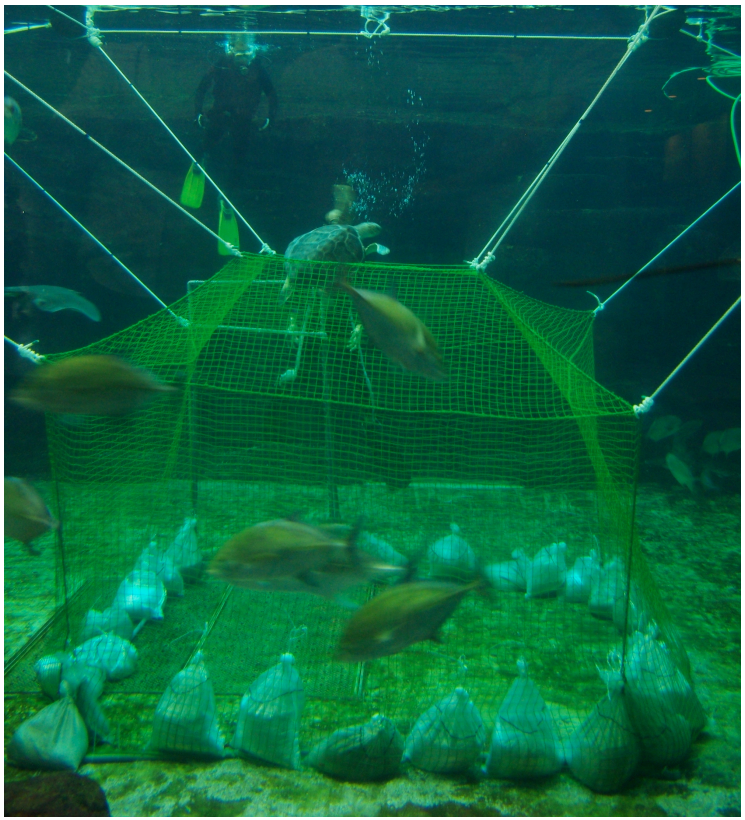




Bycatch workshops held at the Suma aquarium

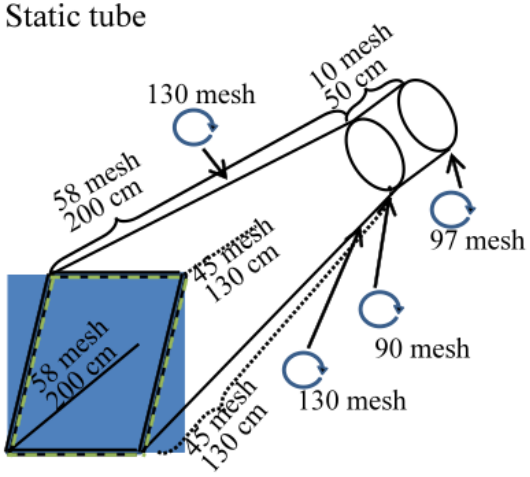
- STAJ initiated series of design workshops to develop escape devices for sea turtles
- Created venue for collaboration
  - fishermen, net manufacturers, researchers, fisheries officials

- Construct a model of the trap end
- Capable of quickly testing different turtle release devices.
- Instant feedback in the design process
- Allowed fishers to see how turtle struggled
  - very moving experience

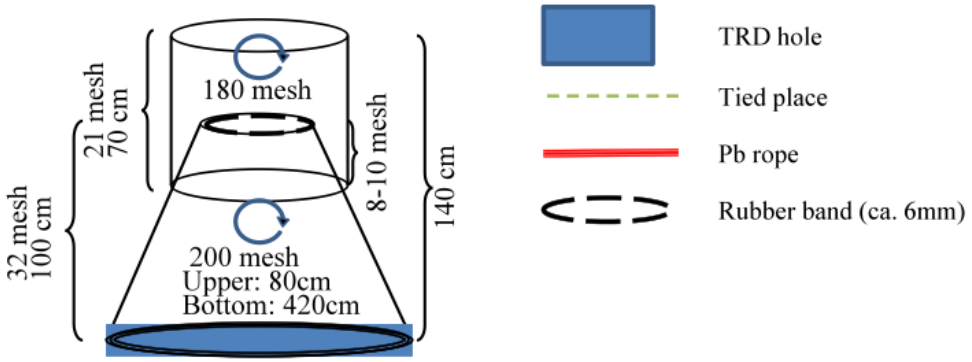


Tested 25 prototype designs, Developed 4 pound net escape devices

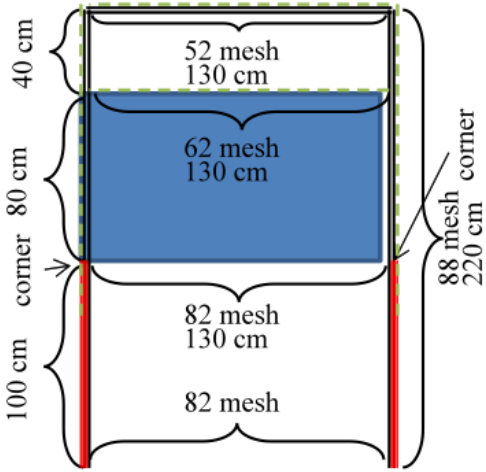
a. Static tube



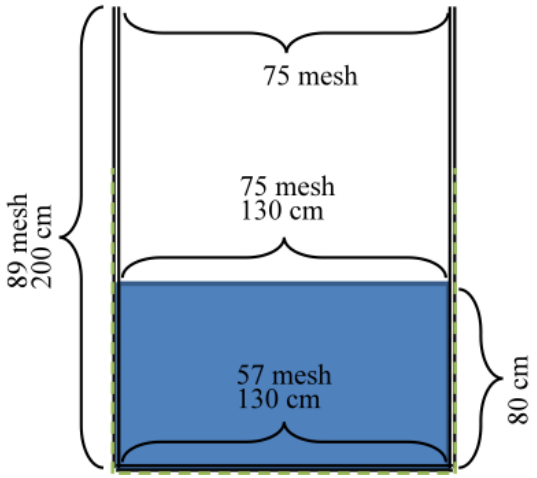
b. Double tube



c. Corner flap



d. Tunnel flap



Venue to engage key stakeholders

Pacific Loggerhead Workshop
Fisheries officials - Spectators

PED Workshop
Fisheries officials - Central collaborators

Workshops helped transform the narrative

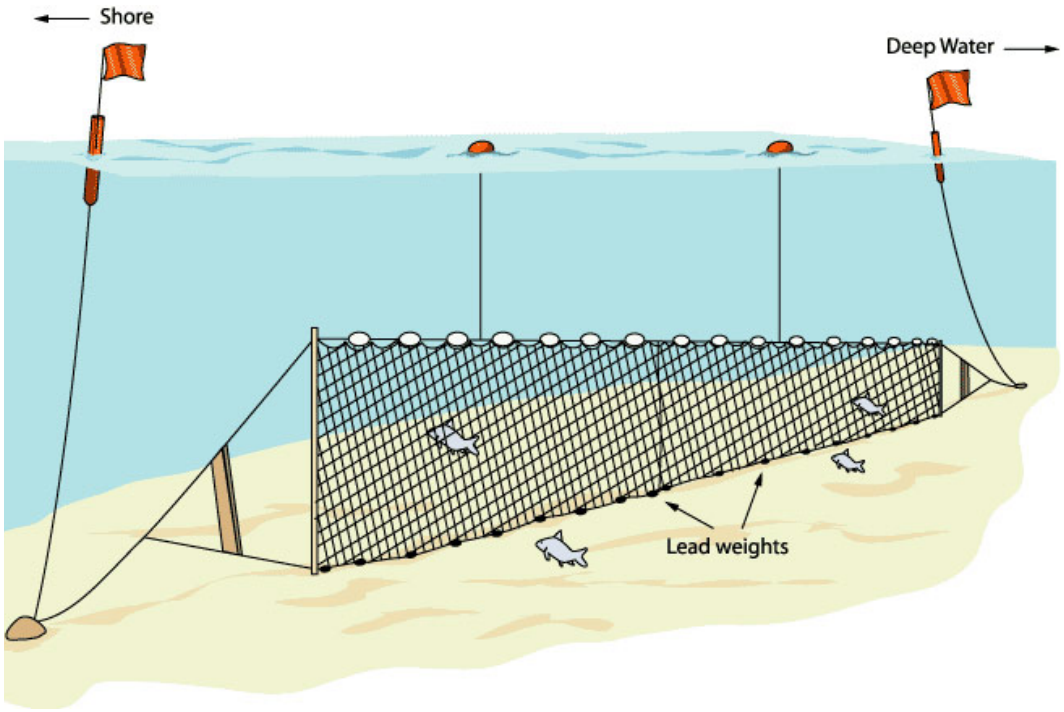
Media coverage:

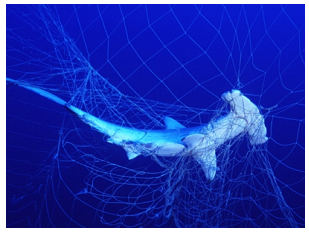
- NHK(national TV)
- Newspapers
- Aquarium visitors

Shift in discourse

II. Coastal gillnet fisheries

- Globally ubiquitous
- Often SSF (*artisanal*)
- Poorly regulated
- Poorly monitored
- Low selectivity
- High interaction rates with sea turtles, sea birds, sharks, marine mammals
- *Few bycatch reduction solutions*



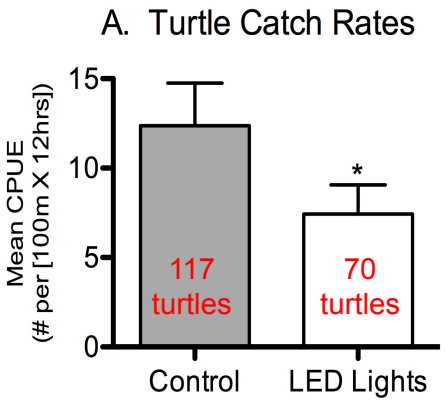


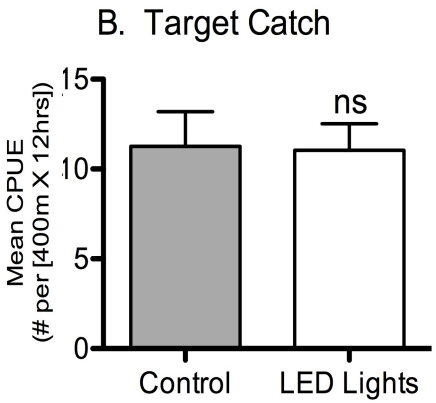
Developing sea turtle BRT for gillnets:

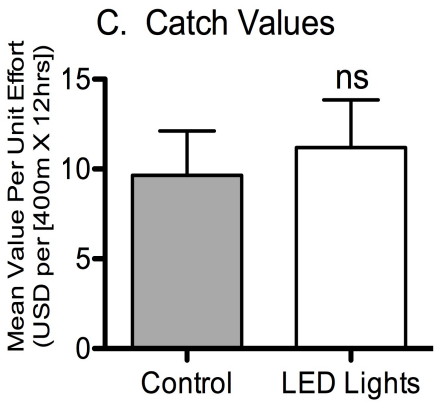
Develop an experimental system in Baja California, MX.

Proving grounds for bycatch reduction ideas

Experimental system
(i.e. Proving grounds)







Net illumination as a visual based BRT:

Reduces sea turtle interactions with gillnets while maintaining target catch rates and catch value

Location	Visual Cue/ Illumination	Turtle Catch Rates	Target Catch Rate	Target Catch Value	Citation
Mexico 	Green Chemi-lights Every 5 m (night)	59% decrease	NO EFFECT	NO EFFECT	Wang et al, 2010
Mexico 	Green LED Every 10 m (night)	40% decrease	NO EFFECT	NO EFFECT	Wang et al, 2010
Mexico 	UV LED Every 5 m (night)	40% decrease	NO EFFECT	NO EFFECT	Wang et al, 2013
Mexico 	Orange LED Every 5 m (night)	50% decrease	NO EFFECT	NO EFFECT	Wang et al, (In Manuscript)

Expansion of net illumination trials:

Testing in several small-scale fisheries

1. Peruvian coastal gillnet fishery
   - Collaboration with ProDelphinus
   - 300+ green sea turtle interactions/year in N. Peru

2. Indonesian coastal gillnet fishery in West Kalimantan (Borneo)
   - Collaboration with WWF–Indo, KKP, Bogor Univ.
   - Fishery occurs off major green sea turtle nesting beach
   - Interactions with leatherback, green, olive ridley, hawksbill sea turtles

3. Pacific Baja California Sur, MX coastal gillnet fishery
   - Collaboration with INAPESCA, Grupo Tortuguero
   - 500-700 Loggerhead sea turtle interactions/year

4. El Salvador/Nicaragua Lobster gillnet fishery
   - Collaboration with ICAPO (E.Pacific Hawksbill Initiative)
   - Interactions with hawksbill sea turtles

Peru: Effects of net illumination in a small scale gillnet fishery

Journal of Applied Ecology

British Ecological Society

Journal of Applied Ecology doi: 10.1111/j.1365-2664.2011.02040.x

Small-scale fisheries of Peru: a major sink for marine turtles in the Pacific

Joanna Alfaro-Shigueto[1,2], Jeffrey C. Mangel[1,2], Francisco Bernedo[2], Peter H. Dutton[3], Jeffrey A. Seminoff[3] and Brendan J. Godley[1]*

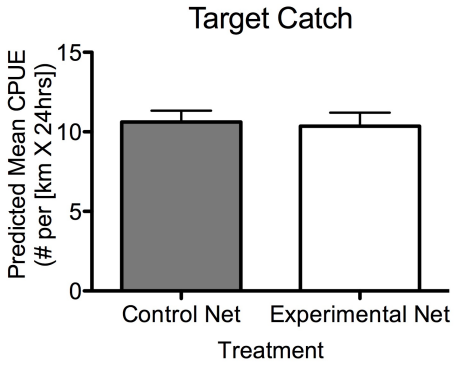
- Identified the SSF (gillnet) in Senchura Bay as one with the highest known sea turtle bycatch rate

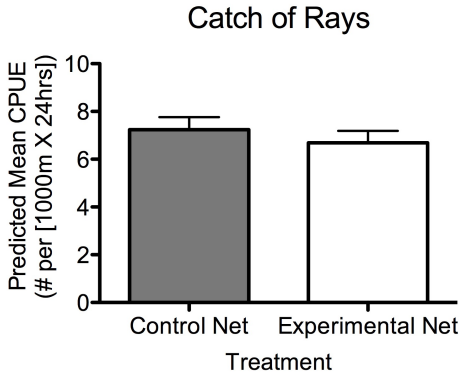
- ProDelphinus has a well established relationship with this fisheries as well as with IMARPE

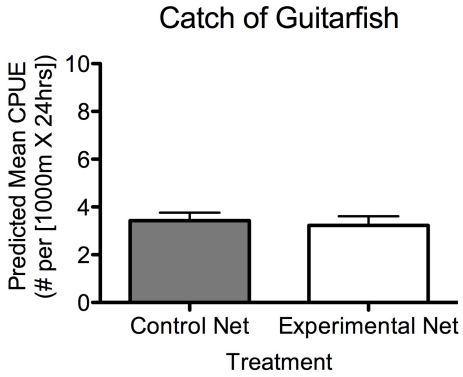
- Conducted paired net trials
  Control nets vs Illuminated nets 

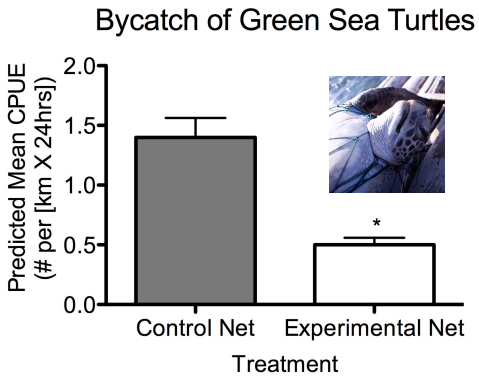
Peru: Effects of net illumination in a small scale gillnet fishery

- Results from 114 paired trials – control net vs green illumination
- Showed no change in total target catch rates and primary catch (Guitarfish and Rays)
- Illuminated nets had significant decreases in interaction rates with bycatch species

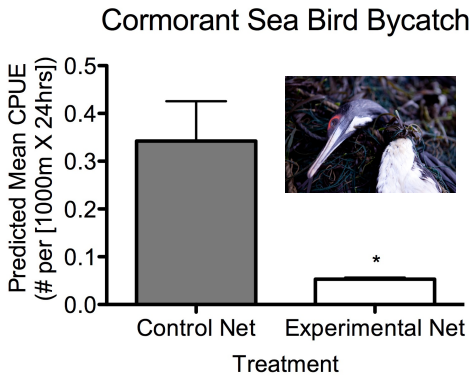




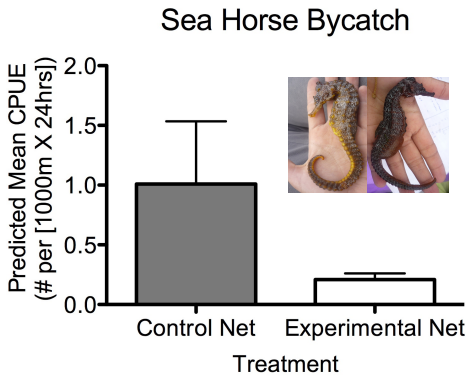




63.9% decrease



84.5% decrease



79.0% decrease

(Ortiz et al., *in review*) Analysis with General Additive Models (R ver 3.1.0), significance: *P<0.05.

Net illumination as a multi-taxa BRT:

- Reductions in sea bird, shark, and marine mammal bycatch
- Increase selectivity of gillnets

Bycatch	Visual Cue/ Illumination	Change in bycatch rates	Target Catch Rate	Target Catch Value
Hammerhead *(Sphyrna spp)* 	UV LED Every 10m	59% decrease (experiments ongoing)	NO EFFECT	NO EFFECT
Sea lions *(O. flavescens)* 	UV LED Every 10m	(experiments ongoing) 29 Con vs 3 Exp	NO EFFECT	NO EFFECT
Porpoises & Dolphins 	UV LED Every 10m	(experiments ongoing) 8 Con vs 0 Exp	NO EFFECT	NO EFFECT

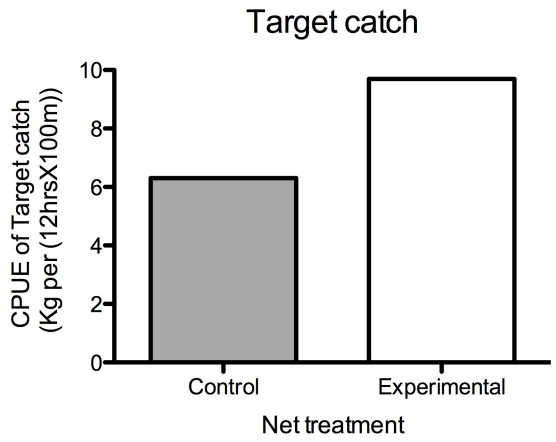
Indonesia: Net illumination in West Kalimantan gillnet fishery

2013 Rapid Assessment – Coastal Indonesian fishery

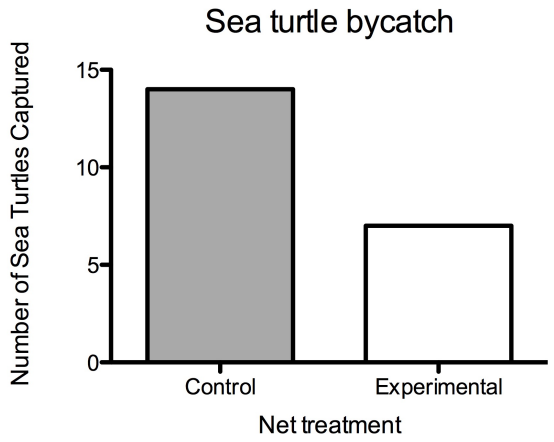
2013 Bycatch Workshop – WWF, KKP, fishermen

2014/15 Fisheries Research - Bycatch Pilot Study

- Conducted observer training in Paloh, West Kalimantan
  - Reviewed observer, experimental, handling protocols
  - Established data management protocols
- Initiated gear trials testing illuminated nets



22% increase in target
(Silver pomfret, black pomfret)

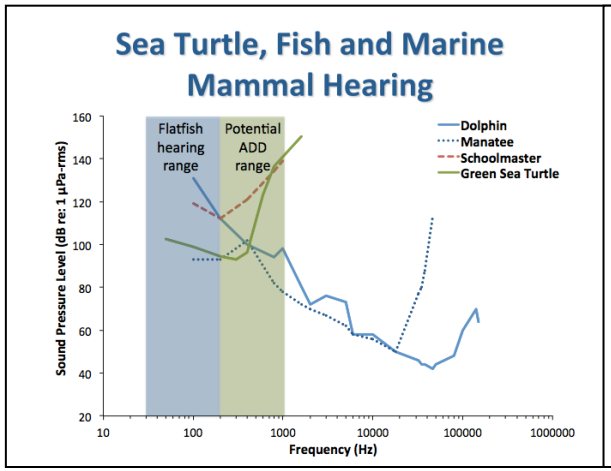


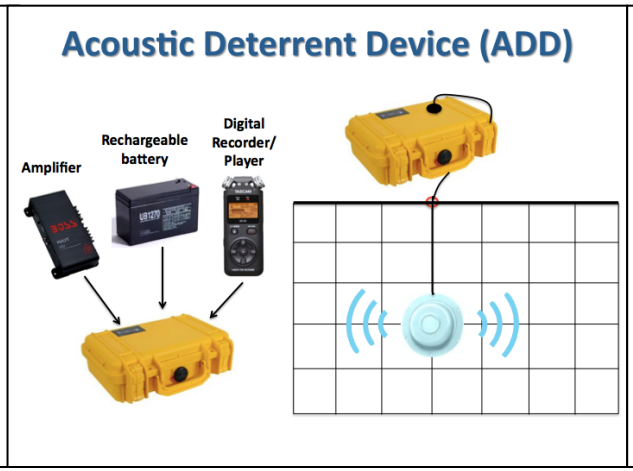
50% decrease in
sea turtle interactions

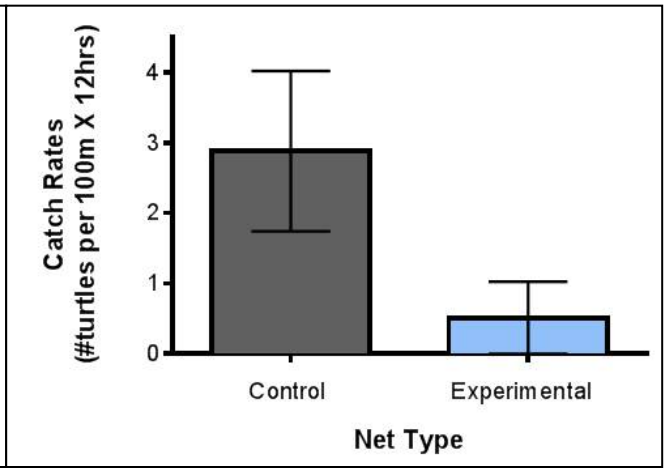
III. New technologies/New Directions

Auditory based and multi-sensory BRTs

1. Baja California - Continue to develop novel sensory based BRT in gillnet fisheries using auditory cues (in collaboration with Wendy Dow Piniak, Ocean Discovery Institute, CONANP)





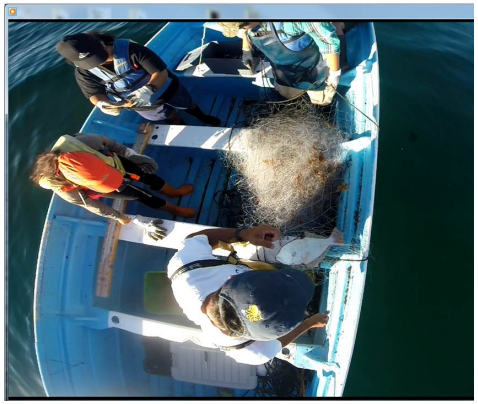


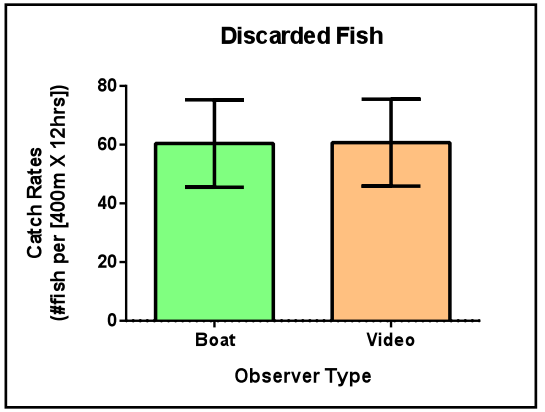
2. Combining visual (net illumination) and auditory cues (ADD) to see if there are synergistic effects

III. New technologies/New Directions

Low cost electronic monitoring systems for SSF

1. Small scale fisheries have very limited observer coverage
   Using remote video technology to increase coverage





2. Partnered with WWF-USA to develop a low cost, scalable EM system
   - Deploying EM devices in Baja MX, Peruvian,
     and Indonesian SSF fisheries

IV. Lessons learned

1. Developing novel BRTS requires large interactions rates with bycatch species

2. Working in international locations is a series of tradeoffs
   - Field sites with potentially larger interaction rates of bycatch species
   - Permitting is not necessarily easier –
     Foreign country permits, NEPA, EO12114
   - Federal contracting with non-US partners is problematic
   - Loss of experimental control
     Information IS lost in the translation
     Reliance on in country partners
     Opportunity for capacity building
   - Funding opportunities may be more complicated
     Reliance on multiple NOAA Partners (IA, S&T International, PIRO)
   - NOAA participation in research is difficult due to travel restrictions

3. It is better to be patient and find the good partners.

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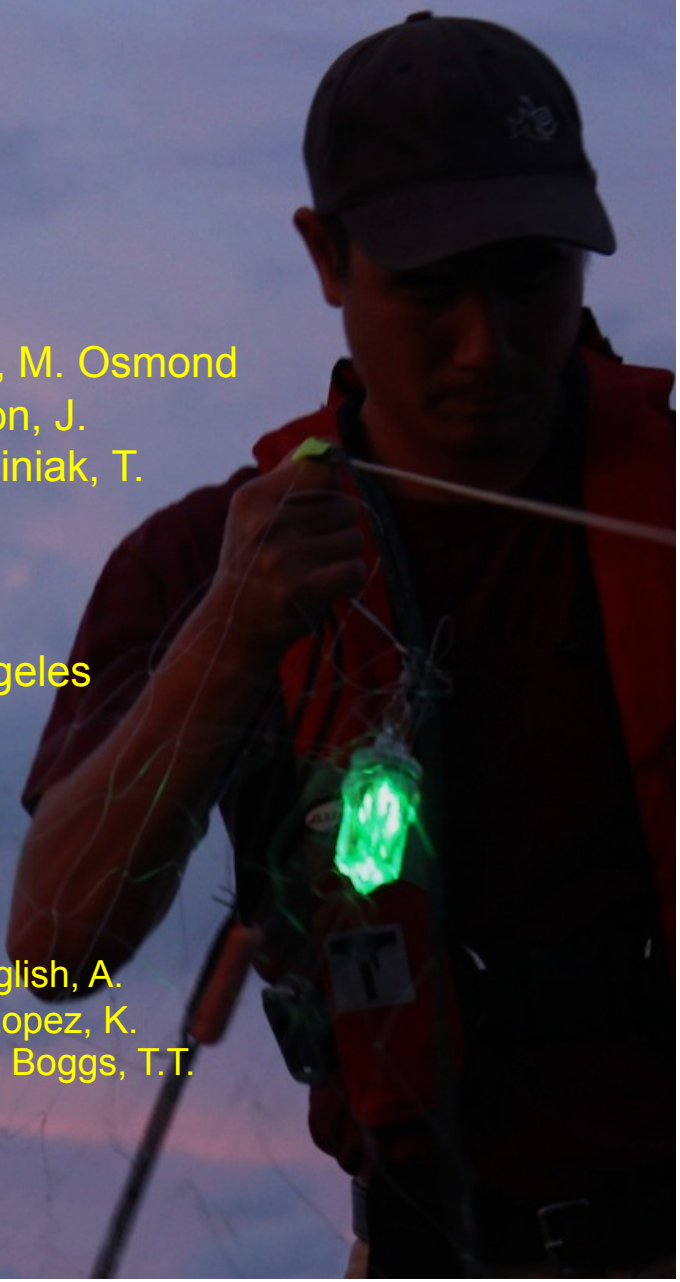


Questions???